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Contact Address:
Prof. Dr. Aytekin İŞMAN
TOJET, Editor in Chief
Sakarya-Turkey

Message from the Editor-in-Chief

Dear Colleagues,

We are very pleased to publish Special Issue 1 for INTE 2015 conference. This issue covers the papers presented at 6th International New Horizons in Education Conference which was held in Barcelona, Spain. These papers are about different research scopes and approaches of new developments and innovation in educational.

Call for Papers

TOJET invites you article contributions. Submitted articles should be about all aspects of educational technology. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. Manuscripts must be submitted in English.

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July 2015
Prof. Dr. Aytekin ISMAN
Sakarya University

Editorial Board

Prospective Chemistry And Science Teachers' Metaphoric Perceptions Of Science

Oya Ağlarci
Marmara University
oyaglarci@hotmail.com

ABSTRACT
The aim of this study is to determine freshmen and senior prospective teachers' views of science by using their metaphors. Case study as a qualitative research design was benefited in the research. 145 prospective chemistry and science teachers from a university in İstanbul were participated in the study. Participants were asked to complete some sentences about science (science is like...;because...). The meaning of metaphor was briefly explained in order to guide the participants to construct relevant metaphors. The data of the study was analyzed with content analysis. It was found that prospective teachers constructed 69 different metaphors under 9 categories including "science is open to change", "science is infinite", "science combines different areas of studies together", "science enlightens/guides people". Among these, the most commonly constructed metaphors were sun (n=11), tree (n=11), light (n=10), ocean (n=7), space (n=7) and book (n=6). The findings of the study showed that most of the participants considered science as a tentative and infinite way. Some conclusions were discussed in the light of the findings.

INTRODUCTION
Science has a vital role in our lives. We search answers to questions of the natural world with the help of scientific studies. Our knowledge of health, transportation, agriculture, technology, education and industry depends heavily on scientific research. Science is a way of knowing and thinking as well as it guides people to understand the universe and social structures (Lederman, 1992). According to the Turkish National Ministry of Education, science is an area that everyone can participate in and make contribution to (MNE, 2007). Even though science addresses all people who are interested in it, there are a lot of different definitions of science in minds and these include misconceptions and myths (McComas, 1998; Abd-El Khalick, 2004). Determining and reducing these misconceptions will help to improve citizens' images of science. In this manner, science education programs and teachers play a key role in this process, as they are mostly responsible for educating people.
The aim of Turkish science teaching programs is to raise scientifically literate students (MNE; 2013). Scientific literacy is defined as "the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (NRC, 1996, p. 22). Citizens who understand the characteristics of science will be able to distinguish pseudo-scientific claims from scientific research and use scientific knowledge in everyday life decision-making processes (Bell & Lederman, 2003). When the number of scientifically literate citizens increases, it is considered that society will have positive views towards science (Driver, Leach, Millar & Scott, 1996). Therefore, it is important to find out what prospective teachers think about science, as they will be mostly responsible for educating students in future. At this point, metaphors play an important part revealing prospective teachers' ideas of science. Thinking with metaphors is an important part of scientific process. Metaphor is defined as "a novel or poetic linguistic expression where one or more words for a concept are used outside of its normal conventional meaning to express a similar concept" (Lakoff, 1993, p. 202). Metaphors help understand and explain concepts as well as they relate solid facts and abstract ideas (Gültekin, 2013). Therefore, metaphors make complex ideas and concepts more understandable (Yıldırım & Şimşek, 2013).
The aim of the study is to find out freshmen and senior prospective teachers' metaphors that they constructed for the concept of "science". The research questions of the study are;

1- What metaphors do prospective chemistry teachers (PCT) and prospective science teachers (PST) construct to define science?
2- Which categories can these metaphors be classified in?

THE STUDY
The study was constructed in the light of constructivist/interpretive paradigm. Prospective teachers' metaphors of science and their explanations were deeply analyzed in a qualitative way. For this purpose, case study as a qualitative design was benefited. According to Yin (2003, p. 13), case study "investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident".

The participants of the study are freshmen and senior prospective chemistry and science teachers from a university in Istanbul. 120 female (83%) and 25 male (17%) students participated in the study voluntarily (Table 1).

Table 1. The distribution of the participants according to their majors and grades

Participants	Female	Male	Total
Freshmen Prospective Chemistry Teachers	14	2	16
Senior Prospective Chemistry Teachers	18	8	26
Freshmen Prospective Science Teachers	43	8	51
Senior Prospective Science Teachers	45	7	52
Total Number	**120**	**25**	**145**

The participants were asked to complete some sentences about science (science is like...;because...). For this purpose, a questionnaire consisting of these open-ended questions were designed. Before administering the questionnaire, the meaning of metaphor was briefly explained in order to guide the participants to construct relevant metaphors. They were asked to write only one metaphor to explain their ideas about science.

The data were analyzed by content analysis technique. The main aim of the content analysis is to reach some relationships that will explain the research data. For this purpose, similar data are brought together within some main concepts, and then they are organized. Finally, themes are constructed to explain data (Yıldırım & Şimşek, 2005). Data were analyzed in five stages according to Saban (2008). In the **coding and elimination stage**, metaphorical images were coded (tree, light, child, etc.). The answers in which metaphors were not clearly constructed were eliminated. In this stage, 8 answers were eliminated. In the **classification stage**, metaphors (n=69) were examined to find similarities with other metaphors. In the **categorization stage,** each metaphor was analyzed in terms of similar characteristics that were related to the *science* concept. 9 different conceptual categories were defined after this inductive analysis procedure. In the **establishing inter-rater reliability** stage, an expert from science education department analyzed the data independently from the researchers. The level of agreement between the expert and the researcher was 92%. According to Miles & Huberman (1994), the analysis is considered to be reliable when there is 80% or over coherence between two codings. In the **last stage**, all of the data were transferred into computer and percentages and frequencies were calculated for each category.

FINDINGS

Participants' metaphors were presented in Table 2. Findings have shown that the participants constructed 69 metaphors. Among these metaphors, the most commonly constructed ones are sun (n=11, 7,59%), tree (n=11, 7,59%), light (n=10; 6,90%), ocean (n=7; 4,82%), space (n=7; 4,82%) and book (n=6; 4,14%).

Table 2. Frequencies and percentages of participants' metaphors for the concept of "science"

Metaphor	Freshmen PC	Senior PCT	Freshmen PS′	Senior PST	Frequency (f	Percentage (%)
Human brain	1	-	-	1	2	1,38%
Locked door	1	-	-	-	1	0,69%
Time	1	-	-	-	1	0,69%
Rocks	1	-	-	-	1	0,69%
Flower seed	1	-	1	-	2	1,38%
Baby tiger	1	-	-	-	1	0,69%
Ocean	**1**	**-**	**2**	**4**	**7**	**4,82%**
Drug	1	-	-	-	1	0,69%
Child	1	1	1	2	5	3,45%
Excavation	1	-	-	-	1	0,69%
Factory	1	-	-	1	2	1,38%
Hope	1	-	-	-	1	0,69%
Baby	1	-	3	-	4	2,76%
Mother	1	-	-	-	1	0,69%
Weapon	1	-	-	-	1	0,69%
Tree	**1**	**3**	**1**	**6**	**11**	**7,59%**
Death	-	1	-	-	1	0,69%
Book	**-**	**2**	**4**	**-**	**6**	**4,14%**
Comma	-	1	-	-	1	0,69%
Space	**-**	**2**	**4**	**1**	**7**	**4,82%**

Human	-	2	1	-	3	2,07%
Kinder surpris	-	1	-	-	1	0,69%
Google	-	1	-	-	1	0,69%
Cocktail	-	1	-	-	1	0,69%
Destructive for	-	1	-	-	1	0,69%
Pomegranate	-	1	-	-	1	0,69%
Fruit salad	-	1	-	1	2	1,38%
Woman	-	1	-	-	1	0,69%
Fashion	-	1	1	1	3	2,07%
Cat	-	1	-	-	1	0,69%
Bag	-	1	-	-	1	0,69%
Black hole	-	1	-	-	1	0,69%
Water	-	1	-	-	1	0,69%
Adventure	-	1	-	-	1	0,69%
Sun	**-**	**1**	**8**	**2**	**11**	**7,59%**
Puzzle	-	-	1	-	1	0,69%
Limitless	-	-	1	1	2	1,38%
Door	-	-	1	-	1	0,69%
Light	**-**	**-**	**3**	**7**	**10**	**6,90%**
Star	-	-	1	-	1	0,69%
Horizon	-	-	1	-	1	0,69%
Nutrition	-	-	1	-	1	0,69%
Path	-	-	2	-	2	1,38%
Plant	-	-	1	-	1	0,69%
Snowball	-	-	1	-	1	0,69%
Tourist guide	-	-	1	-	1	0,69%
House	-	-	1	2	3	2,07%
Earth	-	-	2	1	3	2,07%
Library	-	-	3	-	3	2,07%
Sky	-	-	3	-	3	2,07%
Universe	-	-	1	3	4	2,76%
Tornado	-	-	1	-	1	0,69%
Culture	-	-	-	1	1	0,69%
Human life	-	-	-	1	1	0,69%
Endless well	-	-	-	1	1	0,69%
Ladder	-	-	-	3	3	2,07%
Fish	-	-	-	1	1	0,69%
Pet	-	-	-	1	1	0,69%
Medicine	-	-	-	1	1	0,69%
Pen	-	-	-	1	1	0,69%
2 standing mirrc	-	-	-	1	1	0,69%
Mountain	-	-	-	1	1	0,69%
Diamond	-	-	-	1	1	0,69%
Lighthouse	-	-	-	1	1	0,69%
Domino	-	-	-	1	1	0,69%
Gold mine	-	-	-	1	1	0,69%
Nefron	-	-	-	1	1	0,69%
Past and preser	-	-	-	1	1	0,69%
Istanbul	-	-	-	1	1	0,69%
Total	**16**	**26**	**51**	**52**	**145**	**100%**

The findings have shown that the participants constructed these metaphors under 9 different categories as it can be seen in Table 3.

Table 3. Frequencies and percentages of metaphorical categories for the concept of "science"

Categories	Freshmen PCT	Senior PCT	Freshmen PST	Senior PST	F	%
Science is infinite	2	8	14	6	30	21%
Science is open to change	2	4	13	9	28	19%
Science enlightens/guides/helps people	1	2	13	11	27	18%
Science is open to inquiry/research	2	1	7	6	16	11%
Science combines different areas of studi together	1	5	2	6	14	10%
Science requires effort and practice	2	3	2	6	13	9%
Science involves/produces (new) knowle	2	3	0	6	11	8%
Science is based on solid ground	1	0	0	2	3	2%
Science has both negative and positive effects/sides	3	0	0	0	3	2%
Total	**16**	**26**	**51**	**52**	**145**	**100%**

The results have shown that most of the participants (n=30; 21%) think science is infinite and open to change (n=28; 19%). Some metaphors and explanations in these categories are presented below:

"Science is like time because it never ends. It always keeps on progressing." (Freshmen PCT, 3)
"Time is like comma. Because scientific researches always continue. Science always keeps on going forward." (Senior PCT, 3)
"Science is like horizon because people always try to go beyond their dreams and ideas. They make explanations, then new ideas are added and it keeps on going like that" (Freshmen PST, 15)
"*Science is like a child because a child's likes and dislikes change with the developmental stage. Science looks like this. Scientific theories change with new evidence or reinterpreting the existing knowledge" (Senior PST, 10)*

Also, the majority of them believe science enlightens, guides or helps people (n=27; 18%). Some of the participants underline that science combines different disciplines of inquiry together (n=14; 10%). Some examples for these categories are presented below:

"Science is like sun. Because it enlightens everything around it and it is necessary for life. Science, like sun, guides people and make their lives better." (Senior PCT, 24)
"Science is like a house because, a house consists of rooms such as kitchen, bathroom, living room. Science has branches and they look like rooms. Chemistry is like kitchen." (Senior PST, 28)

16 participants (11%) underline that science is open to inquiry and research and 13 of them (9%) believe that science requires effort and practice. Also, some of the participants (n=11, 8%) think science involves/produces (new) knowledge.

"Science is like a child, because it always asks questions and tries to find answers to these questions. Like a curious child, science seeks answers to the unknown." (Freshmen PCT, 10)
"Science is like tree because in the first place, it takes patience and effort for a long time. After that, scientific knowledge develops." (Senior PCT, 27)
"Science is like factory because it produces new knowledge all the time." (Senior PST, 12)

In Table 4, there are categories for the concept of "science" and some examples from metaphors that the participants have constructed.

Table 4. Metaphorical categories for the concept of "science" and some examples of them

Categories	Metaphors
Science is infinite	-Time, ocean (Freshmen PCT) -Death, comma, space, book, black hole, child (Senior PCT) -Limitless, puzzle, snowball, space, horizon, ocean, earth, sky, universe, path, book, library (Freshmen PST) -Human brain, Endless well, sun, two mirrors facing each other, limitless, space, universe (Senior PST)
Science requires effort	-Mother; flower seed (Freshmen PCT) -Tree, adventure (Senior PCT) -Tree, plant (Freshmen PST) -Culture, pet, child, earth, fish (Senior PST)
Science is open to change	-Human brain, baby (Freshmen PCT) -Human, woman, fashion, cat (Senior PCT) -Baby, human, space, seed, book, child, fashion, earth (Freshmen PST) -Fashion, Istanbul, limitless, universe, tree (Senior PST)
Science combines differen areas of studies together	-Tree (Freshmen PCT) -Human, fruit salad, book, cocktail, tree (Senior PCT) -House, library (Freshmen PST) -House, tree, ocean (Senior PST)
Science enlightens/guides or helps people	-Hope (Freshmen PCT) -Sun, water (Senior PCT) -Light, sun, tourist guide, star, nutrition (Freshmen PST) - sun, light, lighthouse(Senior PST)
Science is based on solid ground	-Rocks (Freshmen PCT) -Ladder (Senior PST)
Science involves/ produces (new) knowledge	-Factory, unlocked door (Freshmen PCT) -Kinder surprise, Pomegranate, Google (Senior PCT) -Ocean, universe, factory, tree (Senior PST)
Science is open to inquiry/research	-Excavation, child (Freshmen PCT) -Bag (Senior PCT) -Ocean, book, human, space, sun (Freshmen PST) -Nefron, gold mine (Senior PST)
Science has both negative and positive effects/sides	Weapon, baby tiger, drug (Freshmen PCT)

CONCLUSIONS

Developing people's images of science is a key goal of science education. Especially teachers have an important role, for they are mostly responsible for educating students. Science educators and science education programmes need to focus on misconceptions about science as the programme's major aim is scientific literacy. Using metaphors is effective for the reflection of students' ideas for various topics. Also, metaphors will enhance students' language skills as well as creativity. In the study, prospective teachers constructed 69 different metaphors under 9 categories. Most of the prospective teachers mention that science is infinite (it never ends) and it is open to change. Their explanations show that they put emphasis on nature of science tenets such as the tentative nature of science. Also, most of the participants view science as a guide. They appreciate the necessity of science for human life. From this point of view, it is possible to say that most of the prospective teachers have contemporary views of science because their explanations are consistent with the science description given by Lederman (1992). Besides these, prospective teachers use both the living (human, animal, plant etc) and inanimate objects (book,light, house) as metaphors. Metaphors can be used as an alternative method when determining both students and teachers' ideas about science or any other concept (including nature of science tenets like theory, law, scientist etc).

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